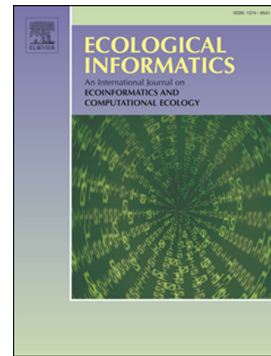


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# UAVs In Pursuit Of Plant Conservation - Real World Experiences

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## ABSTRACT

Small Unmanned Aerial Systems (UASs) (more commonly called Unmanned Aerial Vehicles, UAVs or drones), have the potential to enhance current understanding and management of a range of environmental applications. There has been much coverage on the use of UAVs for conservation applications in the recent years, yet little on specific applications in plant conservation. Here we present our experience of using an off-the-shelf fixed wing UAV in plant conservation projects ranging from Peru's hyper-arid vegetation to the dry forests of the Caribbean and finally to the humid forest of South Africa and the Brazilian Amazon. We present our findings from over ten successful (but also our unsuccessful) field work campaigns flying over 4500 Km. We show how the technology is being used for mapping, quantifying and monitoring plant species, but also review the real-world issues of using UAV's, particularly in remote areas.

**Key words:** UAVs, UASs, Drones, Conservation, Biodiversity, Plant Sciences

## INTRODUCTION

In the past decade, the use of Unmanned Aerial Vehicles (UAV) in ecology and conservation has experienced an exponential growth (Sandbrook, 2015), with an increasing amount of literature being published supporting their use. Between 2013 and 2016 there was a doubling in the number of papers related to the use of UAVs for conservation<sup>1</sup>. The majority of papers suggest that the main use of UAV's in conservation is focused on the counting and monitoring of animals (Marris, 2013; Schiffman, 2014) and law enforcement in relation to illegal hunting (Schiffman, 2014). It is recognised that UAVs provide a flexible, accurate, yet affordable solution to the spatial information needs of many conservation applications (Koh and Wich, 2012). In this paper, we highlight that little attention has been given to the specific issues associated with plant conservation. Here we are treating plant conservation in the broadest sense: i.e. all actions aiming to address the potential loss of plant diversity worldwide (Wyse Jackson and Kennedy, 2009). Applications of UAVs in plant conservation related fields have been extensively documented and reviewed, specifically in ecology (Anderson and Gaston, 2013) conservation (Koh and Wich, 2012) forestry (Torresan *et al.*, 2016) and precision agriculture (Zhang and Kovacs, 2012), as well as in other applications of interests for plant conservation such as mapping vegetated areas (Salamí *et al.*, 2014), photogrammetry and remote sensing (Colomina and Molina, 2014). These applications suggest that UAVs have enormous potential for plant conservation, but bring with them a number of associated issues. These include ease of use, obstacles to moving the system between countries, deployment under different environments and in socially sensitive circumstances. Issues such as the complexity of choosing and setting up a UAV (Torresan *et al.*, 2016) or the social implications of its uses in conservation

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